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T. A. EDISON

MOUNTING FOR DIAMONDS AND THE LIKE

Filed July 6, 1923

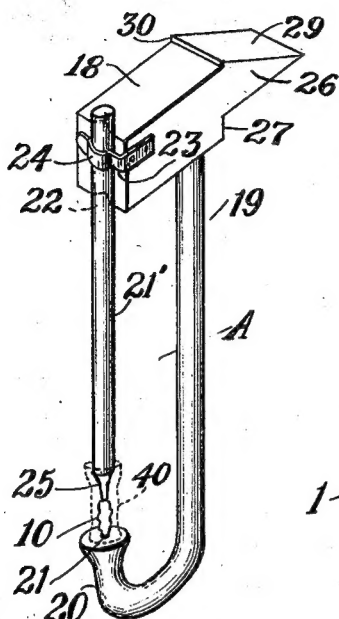


Fig. 2

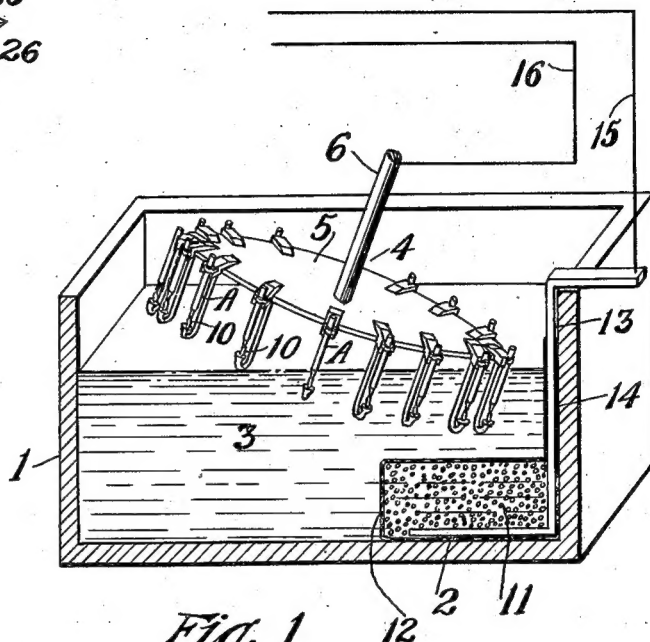


Fig. 1

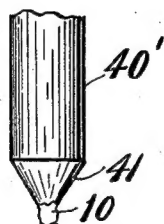


Fig. 4

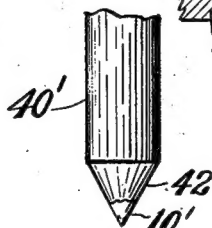


Fig. 5

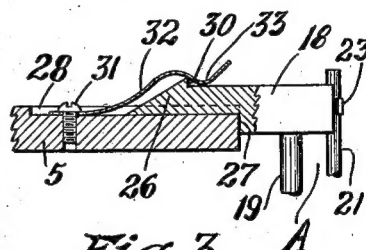


Fig. 3

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UNITED STATES PATENT OFFICE.

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MOUNTING FOR DIAMONDS AND THE LIKE.

Application filed July 6, 1923. Serial No. 649,826.

My invention relates to mountings for diamonds and the like and, while particularly directed to mountings for phonographic styli formed of diamond or sapphire and in which the stylus is partially enclosed in a metal holder and projects from an end portion thereof, it is to be distinctly understood that my invention, as to many of its features, is also applicable to mountings for diamonds or the like used for other purposes such, for example, as for various types of cutting, grinding and truing tools.

The principal object of my invention is to provide an improved mounting of this character whereby the stylus or point, formed of diamond, sapphire or the like, will be very firmly and rigidly secured in its holder so as to effectually prevent the same from being loosened in use.

My invention also resides in an improved method and in improved apparatus for producing mountings of the character described, such improved apparatus constituting the subject matter of my application Serial No. 129,110, entitled Electro-plating apparatus and filed on August 14th, 1926, as a division of the present application.

In producing a mounting, for example, a mounting for a phonograph stylus formed of diamond, in accordance with my invention, I preferably proceed as follows: A small piece of diamond of the proper size and shape for use as a phonograph stylus is first thoroughly cleaned, preferably by immersing the same in hot, dilute nitric acid and then washing the same with distilled water until it is free of nitric acid and absolutely clean. The diamond is then preferably covered with a thin film of stannous chloride as by immersing the same in a solution of the latter. When the diamond has been in this solution for about five minutes, it is removed and washed with distilled water. A thin preliminary coating of conductive material, preferably in the form of a silver mirror, is then applied to the diamond, which is preferably done by immersing the latter in a solution of ammoniacal silver nitrate having definite molecular proportions of ammonia and silver nitrate, and then adding to the solution a suitable reducing agent until the entire surface of the dia-

mond is properly flashed with a coating of pure metallic silver just sufficient in thickness to provide a good conductor. Various reducing agents may be employed such, for example, as cane sugar converted, as for example, by treatment with a suitable acid, into an invert sugar, or dilute formaldehyde, the latter being preferable. The silver coating may be chemically deposited on the diamond in various ways other than that just described, and may also be applied by electrically depositing the same in a vacuum. While it is not absolutely necessary, where the metallic silver is deposited on the diamond from a solution of ammoniacal silver nitrate as described, to apply a coating of stannous chloride to the diamond before forming the silver mirror thereon, I find that such silver mirror is more easily and effectively produced and that the character of the same is improved when this coating is present. After the diamond has been properly flashed with the coating of pure metallic silver, that is, after it is covered with a silver mirror of sufficient thickness, the same is removed from the solution of ammoniacal silver nitrate and washed clean with distilled water, I preferably simultaneously treat a large number of points or splints of diamond or the like to the steps above described.

Mountings for the silver coated diamonds are now preferably produced in situ by electro-depositing metal thereon to a sufficient thickness and then turning down and finishing the holders thus obtained and the diamond points embedded therein to the desired form. To this end the diamonds are preferably electro-plated first with very thin, protective layers of metal, preferably nickel, as by placing the same in a nickel gauze basket constituting the cathode of a nickel plating cell. This cell is provided with a nickel anode, and to form the thin layers of nickel on the diamonds, a current of very low density, preferably about .05 of an ampere is impressed on the cell for a period of about five hours. The thin layers of nickel thus produced are very hard, tough, and dense and are very firmly bonded to the diamonds respectively. As it is unnecessary to handle the diamonds in providing the

same with these thin layers or coatings of nickel, the danger of removal of portions of the thin conductive film or mirror of metallic silver from any of the diamonds is minimized. The diamonds are then electro-plated with metal, preferably nickel, to a sufficient thickness to form holders of the desired size in an electro-plating apparatus or cell the cathode of which comprises a rotary member provided with a plurality of supports or holders of special construction in which the diamonds are mounted, the arrangement being such that in each rotation of the cathode each of the supports and the diamond carried thereby are immersed in the plating bath during a part of such rotation and are out of the plating bath during the remainder of such rotation. Prior to mounting the diamonds and the respective supports therefor in the electro-plating cell, the same are cleaned preferably by immersing the same as cathodes in an electro-cleaning cell the bath of which may consist of a solution of sodium sulphate, so as to remove therefrom all grease and oxides which may be present. Upon removing the supports and the diamonds mounted therein from the electro-cleaning cell, the same are preferably washed with distilled water. The nickel or other metal is preferably deposited on the diamonds in the electro-plating apparatus referred to, in such a manner that it will be less dense than the thin layer of nickel or other metal first deposited thereon. In forming mountings for the diamond styli of Edison phonographs, I preferably plate the diamonds with nickel in this electro-plating apparatus for a period of approximately 72 hours, impressing on such apparatus or cell at the start a current of about .05 of an ampere and then increasing such current at intervals up to about .5 or .6 of an ampere. Accordingly, the holder produced by electro-deposited on each diamond will consist of layers of nickel which decrease in density from the innermost layer outwardly.

An important feature of my invention resides in the employment of a metal which when electro-deposited will be in a state of tension such that the holders or mountings produced as described will grip the styli or tool members embedded therein under pressure. For this reason I prefer to employ nickel, as this metal is electro-deposited in such a high state of tension, that holders or mountings formed thereof will grip or hold the styli or tool members therein under enormous pressure, frequently a pressure of thousands of pounds per square inch. Cobalt may also be used, but the electro-deposition thereof is more difficult to control than is the case with nickel, the same frequently being deposited in such a high state of tension that it cracks or bursts. I find that

styli and tool members are held better and more firmly when mounted as just described than in any other way.

After the diamonds have been plated with metal to the desired thickness, each of the holders so produced is turned down to size and one end thereof and the adjacent end of the diamond embedded therein are preferably cut and ground to a tapered portion formed partly on the holder and partly on the diamond and the surface of which has a continuous taper.

In order that my invention may be more clearly understood, attention is directed to the drawing accompanying and forming a part of this specification, and in which,—

Figure 1 is a partly diagrammatic view in perspective, partly in section, of a preferred form of an electro-plating apparatus or cell employed in producing mountings in accordance with my invention;

Fig. 2 is an enlarged view in perspective of one of the supports for a diamond or the like to be electro-plated and constituting a part of the cathode of the cell shown in Fig. 1;

Fig. 3 is an enlarged detailed view, partly in section and partly in elevation, illustrating how each of the supports for the diamonds is removably secured to the rotatably mounted member comprising part of the cathode of the electro-plating apparatus shown in Fig. 1; and

Figs. 4 and 5 are enlarged, fragmental views in elevation, of my improved mounting showing the same in different stages of completion.

The electro-plating apparatus or cell shown in Fig. 1 in which the diamonds are provided with the final thick deposits of electro-plated metal after the thin coatings of conductive material and electro-plated metal have been applied thereto, comprises a container 1, an anode 2 disposed in the electrolyte or plating bath 3, and a cathode 4 of special construction. The cathode 4 preferably consists of a rotatable member in the form of a disc 5 secured to a shaft 6 which is disposed just above the plating bath 3 for rotation about a fixed axis inclined somewhat from the vertical. A plurality of supports or holders A for the diamonds 10 to be plated are removably mounted on the disc 5 at the peripheral portion thereof and depend from said disc so that in each rotation of the latter each of the diamonds and its holder will be immersed in and moved through the plating bath in a path which closely approaches the anode 2 and will then be removed from the bath. During that portion of each rotation of disc 5 in which each diamond being plated is out of the bath, the plating on the diamond is freed from air bubbles and accordingly such plating is prevented from becoming porous. The anode 2

is preferably disposed in the plating bath 3 adjacent one end of the tank 1 and preferably comprises a mass of nickel shot 11 held in a suitable container 12 of heavy canvass or other porous material. Reference character 13 represents a conductor, preferably of nickel, which extends downwardly in the tank 1 and through and into the container 12 so as to establish contact with the nickel shot 11, this conductor preferably being removed as far as possible from the path of the holders A to thereby prevent the same from being quickly consumed in the operation of the cell. In order further to protect the conductor 13 against electrolytic action, that portion thereof extending from a point just below the top of container 12 and for a considerable distance above the electrolyte 3, is encased in a sheath 14 of rubber or other suitable non-insulating material. Current is supplied to the electro-plating apparatus or cell by means of conductors 15 and 16 extending from a suitable source (not shown), and respectively connected to the contact member 13 and the shaft 6 supporting the rotatable cathode. In the operation of the cell, shaft 6 and cathode 4 are rotated by suitable means (not shown) at a very slow rate, preferably about once every minute.

Each of the holders A consists of a supporting member 18 formed of conducting material, a rod 19 secured to said member at one end and depending therefrom, said rod having a lower end portion 20 extending laterally and then upwardly and being provided at its end with a recess or seat 21, and a small rod or wire 21' mounted on the member 18 for movement towards and from the recess 21. The rod 19 is preferably formed of non-conductive material such as glass, while the small rod or wire 21' is formed of conductive material, preferably steel. Rod 21' is adjustably mounted for reciprocatory or sliding movement in a vertical V-shaped groove 22 formed on the front end or face of the member 18 and is yieldingly held in adjusted position as by means of a spring 23 secured to one end of the member 18 and taking over said rod, the spring being shaped adjacent its free end to conform to the rod 21 as indicated at 24. The lower end portion of the rod 21' is reduced as indicated at 25, and is adapted to be engaged with a diamond 10 when the latter is seated in the recess 21 at the end of rod 19, to thereby secure the diamond in the holder. Each of the supports 18 is provided with a rearward extension 26 cut away on its under side to form a shoulder 27, while the rotatable member or disc 5 is provided on its upper side with a plurality of radially disposed recesses 28 respectively receiving the portions 26 of the supports 18. The inward movement of the holders A with respect to the disc 5 is limited by the engagement of the shoulders 27 on the members 18 with the edge of the disc. The upper face of the portion 26 of each member 18 is bevelled as indicated at 29, a shoulder 30 being formed between the latter and the upper face of the support. Disposed in each of the recesses 28 and secured at one end to the disc 5 as by means of a screw 31, is a leaf spring 32 provided adjacent its free end with an abrupt downwardly deflected portion 33. With the construction described, each of the holders A may be quickly applied to the disc 5 by engaging the portion 26 thereof in one of the recesses 28 and then pushing the holder inwardly until the shoulder 27 abuts the edge of the disc. In so applying the holder the bevelled face 29 engages beneath the free end of spring 32 and presses the latter upwardly as the holder is moved inwardly, and upon the holder reaching the limit of its inward movement, the deflected portion 33 of spring 32 snaps over the shoulder 30 of the holder, as will be apparent from Fig. 3. The spring 32 then coacts with the shoulder 30 and serves to yieldingly and firmly connect the holder to the disc 5. Any of the holders A may also be readily and quickly removed from the disc or rotatable member 5 merely by exerting an outward pull thereon.

In using the electro-plating apparatus or cell above described to produce mountings for diamonds or the like, in accordance with my invention, a plurality of the diamonds 10, after having the thin coatings of conductive material, such as the silver mirrors, and of metal such as nickel, applied thereto as hereinbefore described, are mounted in the supports or holders A as shown. The holders and the diamonds therein are then cleaned to remove all dirt and oxids therefrom by immersing the same for a short time as cathodes in an electrolytic cleaning cell, removing them from the cell and then washing the same with distilled water. The conductive rod or wire 21' of each holder A, with the exception of the reduced lower end portion 25 thereof, is then coated with paraffin or other suitable insulating material, after which the holders are mounted on the rotatable disc 5 as shown. The disc 5 is then rotated and current is impressed on the electro-plating cell as above described until each of the diamonds is plated with a mass of nickel or other metal of sufficient thickness to provide a holder therefor. This holder of electro-deposited nickel or other metal represented by reference character 40 (Fig. 2) is somewhat irregular in shape and extends up on the latter only to the top of its reduced end portion 25. Both the reduced end portions 25 of rods 21' and the points or splints 10 of diamond or the like

will be embedded in the holders 40. Obviously one end of each of the diamonds will be closely adjacent one end of the holder in which it is embedded. The rods 21' together with the holders 40 and the diamonds 10 embedded therein are now removed from holder A, each holder 40 then being separated from the corresponding rod 21' by severing the latter closely adjacent the top of the holder. The holders 40 are then each turned down to proper size as indicated at 40' in Fig. 4, and material is removed or cut away from one end portion thereof so as to provide the same with a tapered portion 41 from which a portion of the diamond 10 projects. Where the mountings to be produced are for phonograph styli, the end portion 41 of each holder and the projecting portion of the stylus 10 are then ground down to form a conical end portion having a continuous tapered surface 42 formed partly on the holder and partly on the stylus, after which the end of the stylus is rounded as indicated at 10' so as properly to fit the record grooves with which the stylus is designed to be used.

A mounting for a diamond stylus or the like, produced as above described, comprises a holder for the stylus which grips the same very firmly, being substantially entirely formed of electro-deposited nickel or other metal. In this connection, it may be noted that the portion 25 of rod 21' embedded in the holder for the diamond is so small that as a practical matter it is negligible.

While I have described the preferred form of mounting in accordance with my invention, and the preferred method and apparatus for producing the same, it is to be understood that the same are subject to many changes and modifications without departure from the spirit of the invention and the scope of the appended claims.

Having now described my invention, what I claim as new and desire to protect by Letters Patent, is as follows:—

1. A device of the character described comprising a stylus or tool member and a holder within which the said stylus or tool member is secured, said holder consisting of electro-deposited metal in a state of tension, substantially as described.

2. A device of the class described comprising a member, and a holder for said member in which the latter is embedded, substantially all of said holder being formed of electro-deposited metal in a state of tension, substantially as described.

3. A device of the character described comprising a member, and a holder for said member in which the latter is embedded, substantially all of said holder being formed of electro-deposited nickel, substantially as described.

4. A device of the character described

comprising a member, and a holder for said member in which the latter is embedded, said holder comprising portions formed of electro-deposited metal of different densities, substantially as described.

5. A device of the character described, comprising a member and a holder for said member in which the latter is embedded, said holder being formed of electro-deposited metal the density of which gradually decreases from the inner portion of the holder outwardly, substantially as described.

6. A device of the character described comprising a member, and a holder for said member in which the latter is embedded, substantially all of said holder being formed of electro-deposited metal and the portion thereof adjacent said member being of greater density than the outer portion thereof, substantially as described.

7. A stylus mounting comprising a holder and a stylus partially embedded in said holder and extending therefrom, substantially all of said holder being formed of electro-deposited metal in a state of tension, substantially as described.

8. A stylus mounting comprising a holder, and a stylus partially embedded in the holder and projecting from one end thereof, the projecting end of the stylus and the adjacent portion of the holder being formed into a tapered portion having a continuous taper formed partly on the holder and partly on the stylus, substantially all of said holder being formed of electro-deposited metal, substantially as described.

9. The method of mounting a stylus or tool member which consists in applying thereto a coating of conductive material and then electro-depositing thereon metal having the property of being placed in a state of tension when electro-deposited whereby such metal will grip said stylus or member under pressure, substantially as described.

10. The method of producing a mounting for a member such as a diamond stylus or the like, which consists in providing said member with a coating in the form of a film of stannous chloride, then chemically depositing a silver mirror on said member, and then forming a holder for such member by electro-depositing metal thereon, substantially as described.

11. The method of producing a mounting for a member formed of diamond or the like, which consists in chemically depositing a coating in the form of a silver mirror on said member by immersing the same in a solution of ammoniacal silver nitrate and then adding a reducing agent to said solution, and then forming a holder for said member by electro-depositing metal thereon, substantially as described.

12. The method of producing a mounting for a member formed of diamond or the

like, which consists in chemically depositing a coating in the form of a silver mirror on said member by immersing the same in a solution of ammoniacal silver nitrate and then adding formaldehyde to said solution, and then forming a holder for said member by electro-depositing metal thereon, substantially as described.

13. The method of producing a mounting for a member formed of diamond or the like, which consists in applying a thin coating of conductive material to said member, and then forming a holder for said member by electro-depositing thereon layers of metal of different densities, substantially as described.

14. The method of producing a mounting for a member formed of diamond or the like, which consists in applying a thin coating of conductive material to said member, then electro-depositing on said member a thin, dense layer of metal and then electro-depositing on said layer metal of a less density, substantially as described.

15. The method of producing a mounting for a member formed of diamond or the like, which consists in applying a thin coating of conductive material to said member and then successively electro-depositing on said member layers of metal of decreasing density, substantially as described.

16. The method of producing a mounting for a member formed of diamond or the like, which consists in applying a thin coating of conductive material to said member, then electro-depositing metal on said member so as to produce a holder in which the member is embedded with one end thereof adjacent one end of the holder, and then

removing material from the adjacent end portions of the holder and the member so as to produce a surface formed partly on the holder and partly on the member and having a continuous taper, substantially as described.

17. The steps in the method of producing a mounting for a member formed of diamond or the like, which consists in applying a thin coating of conductive material to said member, then electro-depositing metal on said member so as to produce a holder in which the member is embedded with one end thereof adjacent one end of the holder, and then removing material from an end portion of said holder so as to leave one end portion of said member projecting from the holder, substantially as described.

18. The method of producing a mounting for a member formed of diamond or the like, which consists in applying a thin coating of conductive material to said member, then electro-depositing metal on said member so as to produce a holder in which the member is embedded with one end adjacent one end of the holder, then removing material from the end of said holder adjacent said end of said member so as to leave said member projecting from the holder, and then forming the projecting end of said member and the adjacent end of the holder into a portion having a continuous tapered surface formed partly on the holder and partly on the member, substantially as described.

This specification signed this 28th day of June 1923.

THOS. A. EDISON.